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Tech week in the world of dance and theater is a major headache for producers. It requires booking back-to-back rehearsals in the theater space, making the most out of the stage prior to opening night.

Approach

- **Variables:** The hour-long slot of a choreographer's rehearsal
- **Domains:** The times that the stage is open
- **Constraints:**
 - Hard Constraints:
 - Choreographer's availability
 - Soft Constraints (that can be relaxed if necessary):
 - The dancers in the choreographer's piece availability
 - Non-Harvard college dancers have all their rehearsals scheduled on the same day

- Depth first search
- MRV and LCV heuristic with backtracking
- Stochastic gradient descent

To determine the best schedule, for each solution I evaluated its optimality by weighting the constraints it violated.



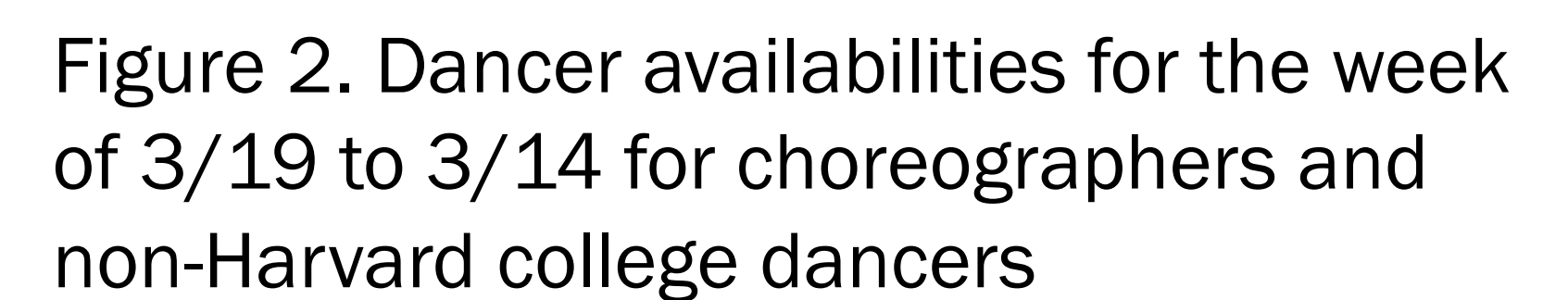
In this project, I create a rehearsal scheduler to automate the often tedious process of making a master tech week schedule, which requires working around 20 – 30 student schedules. My scheduler delivers the optimal solution when possible and if not, utilizes various heuristics and probabilistic methods to approximate the best solution.

Figure 1. Tech Week schedule from *CityScapes* (purple = rehearsals, grey = unavailable, blue = dress rehearsal)

Dataset	Traditional Method	CSP Solver using DFS
Oz	Violations: 10 Score: 18	Violations: 4 Score: 6
Cityscapes	Violations: 5 Score: 22	Violations: 0 Score: 19
In Passage	Violations: 8 Score: 7	Violations: 2 Score: 1

The CSP solver manages to find a much better solution than the manual way of creating the schedule. Furthermore, it is able to produce a solution in on average 0.003 seconds (while in my past experience, the process took at least 1.5 hours).

Not shown, but the heuristic method works very well as well, achieving the same scores as the exhaustive DFS in some cases.



In the future, I would like to implement a GUI for this program so that producers can run the scheduler without needing the code and dancers can enter their availability via a weblink. I would also like to add explore more randomized methods, since DFS can be time-consuming . Overall, I hope my project will be useful piece of software that the Harvard Ballet Company can use for years to come.

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